

## REMARKS

### **I. §103 Rejection**

The Examiner has rejected claims 1, 3, 5-10 and 14-44 under 35 U.S.C. 103(a) as being unpatentable over EP 0113381 of Banta et al. in view of publication WO 98/01515 of Moureaux and U.S. 4,376,036 to Garwood et al. Reconsideration and withdrawal of this rejection are respectfully requested in view of the following remarks.

#### **A. Summary of the Cited Prior Art**

##### *The Banta Publication (EP 0 133 381)*

The Banta publication discloses a process for the simultaneous dewaxing and desulfurization of heavy petroleum oils. See e.g., page 1, first paragraph; and page 2. Banta teaches that its catalyst composition preferably contains from 70 to 95% alumina, silica or silica-alumina support material and from 5 to 30% zeolite. See page 3, lines 28-33. Banta further teaches that it is significant that the amount of zeolite in its catalyst composition is preferably restricted to a relatively low level, see page 3, lines 31-34, because, as Banta indicates, large amounts of zeolite may negatively affect the desulfurization activity of the catalyst without having any compensating effect on its dewaxing activity. See page 3, line 34 – page 4, line 2.

Throughout its examples, the Banta publication notes that the presence of up to a certain percentage amount of zeolite in the Banta catalyst provides for the reduction of the pour point reduction of certain feeds, but it does not provide for a reduction of sulfur content. See e.g. page 8, lines 1-2; and page 13, second and last paragraphs. Banta also teaches that its catalyst requires the presence of Group VIA and/or Group VIII metal compounds to provide a hydrogenation function for desulfurization. See page 4, lines 3-14; and page 13, last paragraph. The preferred Group VIA metals are tungsten and molybdenum, and the preferred Group VIII metals are cobalt and nickel. See page 4, lines 8-10. The especially preferred combination of metals is nickel and molybdenum, both as oxides. See page 4, lines 10-12.

In the examples of the Banta publication it is suggested that the catalyst of the invention should contain a certain maximum amount of zeolite and both nickel and molybdenum components. For instance, Banta states that “[t]he hydrogenation function, attributable to the nickel (or cobalt) and molybdenum is also needed in the catalyst.” See page 13, last paragraph. And, supporting this statement, Banta states that its catalyst containing nickel and molybdenum

with only 30% ZSM-5 was much more effective for both dewaxing and desulfurization than a catalyst containing a greater amount (65%) of ZSM-5 zeolite but with only 1% nickel. See page 14, second paragraph of Example 4. The catalysts described in the Banta examples each contain alumina as the support material. See Examples 1-8.

In summary, Banta teaches that only up to a certain content level of ZSM-5 in its catalyst is there provided a dewaxing benefit and that the use of the ZSM-5 alone does not provide a desulfurization benefit. Also, Banta teaches that the presence of nickel alone in its catalyst does not provide for as much of a desulfurization benefit as does the presence of both nickel and molybdenum. The Banta publication nowhere teaches the need to use a surface dealuminated aluminosilicate zeolite with a low acidity refractory oxide binder material that is essentially free of alumina; but, instead, Banta indicates that a large proportion of its catalyst may include alumina.

*The Moureaux Publication (WO 98/01515)*

The Moureaux publication discloses a process for the preparation of lubricating base oils that necessarily includes two reaction stages with an intermediate separation step between the two reaction stages. *See* Abstract; page 1, lines 2-8; page 5, lines 7-25; page 9, lines 30-32; page 10, line 31-page 11, line 18; page 17, line 31-page 18, line 4; claim 1; and Figures 1 and 2. The first reaction stage is a hydrotreating step used to remove sulfur and nitrogen from a hydrocarbon feed using a catalyst comprising both a Group VIB metal component and a non-noble Group VIII metal component supported on a refractory oxide carrier. *See* page 5, lines 10-14; page 6, line 14-page 7, line 20. The importance of the sulfur and nitrogen removal reaction step is emphasized. *See* page 9, line 1-page 10, line 3. It is noted that the noble-metal based catalyst used in the second reaction step is sensitive to poisoning by sulfur and nitrogen. *See* page 9, lines 9-15.

The product from the first reaction step is to be separated into a gaseous fraction and a liquid fraction. *See* page 9, lines 30-32. The first reaction step is to be operated so as to provide the liquid fraction having less than 1000 ppmw sulfur and less than 50 ppmw nitrogen. *See* page 9, lines 1-7; page 9, line 32-page 10, line 3. But, it is preferred for these concentrations to be much lower such as less than 500 ppmw sulfur and less than 30 ppmw nitrogen. *Ibid.*

The second reaction stage may provide the two functions of hydrofinishing (hydrogenation of aromatics) and hydrodewaxing (hydroisomerization), or a single function of hydrofinishing alone, configured in a variety of ways. *See* page 10, line 31-page 11, line 33. The

dewaxing catalyst may be selected from those known in the art, such as, dewaxing catalysts comprising a noble metal (platinum or palladium) supported on an intermediate pore size zeolitic material. Another class of dewaxing catalyst comprises a noble metal component supported on a surface deactivated aluminosilicate.

A significant aspect of the teachings of the Moureaux publication is that the first reaction stage of the process is necessary so as to provide for the removal of sulfur from sulfur-containing feedstocks in order to protect the noble metal based catalyst of the second reaction stage. The dewaxing catalyst of the Moureaux publication contains a noble Group VIII metal component supported on a surface dealuminated aluminosilicate as disclosed in European patent application EP 0 832 171. This noble metal based catalyst is sensitive to being poisoned by sulfur and nitrogen contaminants in a feedstock to be treated which is the reason for the desulfurization stage of the Moureaux process.

*The Garwood et al. Patent (U.S. 4,376,036)*

In the background section of the Garwood patent it states that the current practice in preparing a high-grade distillate lubricating oil is by the dewaxing of a raffinate from the solvent extraction of a raw stock material resulting from the vacuum distillation of an atmospheric tower residuum. See column 2, lines 8-20. Garwood et al. describe their invention as being a process for the catalytic dewaxing of a distillate petroleum fraction using a silica-modified ZSM-5 type zeolite. See e.g. column 3, lines 40-46 and the claims. The preferred embodiment involves the catalytic dewaxing of a raffinate from a solvent extraction step. See column 4, lines 11-20. This catalytic dewaxing is conducted by contacting the raffinate under appropriate dewaxing conditions with the silica-modified ZSM-5 type zeolite. The silica-modified ZSM-5 includes from 0.1 to about 30 weight percent silica that has been added to the zeolite by treatment with either an organic silicone compound or an organic silane compound, or both. See column 4, line 51 – column 5, line 7.

It is significant in the teachings of the Garwood et al. patent that the distillate petroleum fraction that is subjected to catalytic dewaxing is subjected to a solvent extraction step prior to the catalytic dewaxing step. Concerning the catalyst, there is no mention that the silica-modified ZSM-5 zeolite catalyst may contain a Group VIII metal, and the dewaxing process requires the use of a silica-modified zeolite.

## **B. Response to the Examiner's Arguments**

The Examiner acknowledges that the primary reference of Banta does not disclose the use of a dewaxing catalyst containing a dealuminated zeolite or the dewaxing of a feed obtained by the vacuum distillation of an atmospheric residue followed by a solvent extraction. However, the Examiner argues that one skilled in the art would have modified the process of Banta by using the teachings of the Garwood patent to provide a feedstock for catalytic dewaxing that is a vacuum distillate of an atmospheric residue that has been extracted with a solvent. The Examiner argues that one skilled in the art would further modify the Banta process by using the teachings of the Moureaux publication to change the dewaxing catalyst that the Banta patent specifies for use in its process to include a dealuminated aluminosilicate zeolite. The substitution of the Garwood feedstock for the Banta feedstock is argued by the Examiner to be proper because the Garwood feed allegedly has an appropriate boiling range for the preparation of the desired products of the Banta publication. As for the substitution of the dealuminated zeolite-containing dewaxing catalyst taught by the Moureaux publication for use in the process of the Banta publication, the Examiner circularly argues that such a substitution is obvious because the catalyst has dewaxing activity that is essential to the process of the Banta patent.

The applicant s submit that the teachings of Banta and those of Moureaux are in such conflict that it is improper to combine them in the way the Examiner has done. For instance, the Banta invention is directed to a process for the simultaneous hydrodesulfurization and hydrodewaxing of a feedstock having a high sulfur content. But, on the other hand, the Moureaux teachings are concerned with a process that particularly provides for the reduction of the sulfur content of a dewaxing feedstock prior to subjecting it to a catalytic dewaxing step that uses a sulfur sensitive dewaxing catalyst comprising a noble metal component supported on an amorphous refractory oxide carrier. Thus, one would not be lead to use the sulfur sensitive dewaxing catalyst of the Moureaux publication as a substitute for the catalyst of the Banta publication for use in simultaneous hydrodesulfurization and hydrodewaxing since the Banta catalyst is being used to treat a high sulfur content feedstock.

In another example of the conflict between the teachings of Banta and those of Moureaux, Banta teaches that its catalyst should contain a relatively low amount of zeolite, preferably in the range of from 5 to 30%; but, in contrast, Moureaux, by its reference to the European patent specification no. 96921992.2, indicates that its dewaxing catalyst may contain a

weight ratio of modified molecular sieve to binder in the range of from 10/90 to 90/10, and most preferably from 50/50 to 80/20. Aside from the major differences in the forms of the zeolites used in the two different catalysts, it is preferred for the Banta catalyst to have a low amount of zeolite but for the Moureaux catalyst to have a high amount of zeolite.

Still another difference between the teachings of Banta and Moureaux is that the Banta catalyst contains a non-noble Group VIII metal whereas the Moureaux catalyst is a noble metal-containing catalyst. Banta indicates that its preferred metal combination is nickel and molybdenum that provides for the hydrogenation function for desulfurization. On the other hand, the Moureaux catalyst contains a noble metal that is sensitive to sulfur poisoning.

It is additionally noted that the catalyst disclosed in the European specification no. 96921992.2 (Grandvallet) as referenced by Moureaux contains a noble metal component supported on a surface dealuminated aluminosilicate zeolite and that the binder that is used in forming the catalyst should be essentially free of aluminum, thus, the list of suitable binder materials for such catalyst does not include alumina. See Grandvallet at page 5, lines 18-25. But, Banta indicates that its catalyst may contain from 20 to 99% alumina mixed with a ZSM-5 type zeolite. Based on these teachings, it is improper to combine the dealuminated zeolite of the Moureaux catalyst (i.e. the catalyst described in Grandvallet) for the zeolite of the Banta catalyst since it is taught that the alumina should not be present in the catalyst. See Grandvallet at page 5, lines 18-25.

Considering the above-noted differences and conflicts between the teachings of Banta and of Moureaux, the applicant respectfully submits that they are not properly combinable.

Concerning the application of the Garwood patent, the Examiner argues that its teachings that a feedstock obtained from the solvent extraction of a vacuum distillate of an atmospheric resid may be catalytically dewaxed may be used to modify the Banta process so that it includes the processing of such a feedstock. The problem with this combination is that there is nothing in the teachings of the two references to suggest it. The dewaxing catalysts taught in the two references are substantially different and there is no mention in Garwood of its feed containing sulfur. And, if anything, the requirement in Banta that its catalyst must contain a metal that provides a hydrogenation function should prevent the combining of the references since the dewaxing catalyst of Garwood is merely a silica-modified zeolite. There is no indication in Garwood that its catalyst is useful in the desulfurization of a feedstock, and according to the Banta teachings, a catalyst containing only zeolite does not provide desulfurization activity.

Considering the above-noted differences between the teachings of Banta and of Moureaux, the applicants respectfully submit that they are not properly combinable.


Even if the three cited references are combinable in the way suggested by the Examiner, it is submitted that such a combination will not provide applicant's taught process. Applicants' invention is directed to a catalytic dewaxing process that uses a catalyst that is less sensitive to sulfur poisoning than alternative dewaxing catalysts and is therefore capable of handling a feedstock having a high sulfur concentration. This is significantly different from the process of Banta that simultaneously desulfurizes and dewaxes a high sulfur feedstock. As is indicated in the applicant's specification, the catalytically dewaxed product is what is desulfurized instead of the feed to the catalytic dewaxing step. See applicants' spec at page 6, lines 10-13 and page 7, lines 15-18. To illustrate this, the applicants present in their specification an example demonstrating the advantages of first conducting a catalytic dewaxing step prior to a hydrodesulfurization step. See Examples 5 and 6. Another problem with the Examiner's combination of references is that the catalyst of Banta requires a relatively low zeolite content while the applicants' catalyst may have a high zeolite content. See applicants' spec at page 11, lines 28-30. Also, the binder material of the applicants' catalyst is a low acidity refractory oxide material which is essentially free of alumina, see applicants' spec at page 9, lines 4-9; page 11, lines 22-28; and Examples 1-3, whereas the Banta catalyst may include a significant amount of alumina. The applicants have shown in their examples that the significant presence of alumina in its dewaxing catalyst is not desired.

### C. Conclusion

In view of the above comments, applicants suggest that claims 1, 3, 5-10, and 14-44 pending in this application are patentable over the prior art. Early allowance of these claims is therefore respectfully requested.

Respectfully submitted,

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